

Engineering Mathematics :-

* عرضي *

- Differentiation [order, degree, linearity, homogenous]
from of D.E.
- First order first degree D.E.
= Method of Solution.
 - separable or can be separable.
 - Exact or can be exact.
 - Linear or " " linear.
 - homogenous " " homogenous.
- First order but not first degree.
and its applications:
 - orthogonal Trajectories.
 - heat transfer & electric ct.
 - falling body.
- Linear differential eqn:
 - The differential operator method.
 - The undetermined coefficient.
 - The variation of parameters method.

* Definitions *

* **order**: The highest derivative in the diff eqn.

* **Degree**: The ^{highest} power of the order.

* **Linear**: $y, y', y'', y''' \dots$ $\oplus$ ✓

$\sin y, \cos y \dots$ ✗

$(\ln) y, x^y, x^x, x^{x^y} \dots$ ✗

* **Homogenous**: $y', y'', y''' \dots = 0 \rightarrow$ homogenous.
 $\neq 0 \rightarrow$ value $\rightarrow$ non homogenous.

$$y' A = y$$

Ex:

order Degree Linear Homog

① $\frac{dy}{dx} = 2x + 3$ 1 1 ✓ ✗

② $\frac{d^2y}{dx^2} + 3 \frac{dy}{dx} + 9y = 0$ 2 1 ✓ ✓

③ $\frac{d^3y}{dx^3} + \left(\frac{dy}{dx}\right)^4 + 6y = 3$ 3 1 ✗ ✗

④ $y''^3 + y^5 + 3 = 0$ 2 3 ✗ ✗

⑤ $y'' - \sin y = 0$ 2 1 ✗ ✓

⑥ $y' + y^2 = 2x$ 1 2 ✗ ✗

* Form of D.E.

$$y = Ax \rightarrow \text{①}$$

$$y' = x \rightarrow \text{②}$$

② into ①

$$\text{D.E.} \rightarrow \therefore \boxed{y = Ay'} \quad \#$$

ex: Find the D.E of $y = A \cos x + B \sin x$

Sol

$$y = A \cos x + B \sin x \rightarrow \text{①}$$

$$y' = -A \sin x + B \cos x$$

$$y'' = -A \cos x - B \sin x = -(A \cos x + B \sin x)$$

① Into ②

$$y'' = -y$$

$$\boxed{y'' + y = 0}$$

ex: check for $y'' + y = 0 \rightarrow *$

If $y = A \cos x + B \sin x$

$y' = -A \sin x + B \cos x$

$y'' = -A \cos x - B \sin x$

"Solution"

1st

$y = A \cos x + B \sin x \rightarrow ①$

$y' = -A \sin x + B \cos x$

$y'' = -(A \cos x + B \sin x) \rightarrow ②$

②, ① into *

$\therefore$ as well as *

!...! is

Reference: Advanced Engineering Mathematics. ch 5, 6.

① as well as *